William Pickering Presents JPL: The Early Years

Larry Palkovic

Like Norm Haynes' presentation last December 4, the audience is filled with the buzz of old timers, catching up. "Dr. Bill's" stories promise to throw a light on the earliest days at the Lab (Pickering was at Caltech as early as 1929—even before Frank Malina began his now-famous experiments into rocketry). After a brief, but glowing introduction by the Library's Teresa Bailey, the former director faces the generous applause of the friendly audience as the first storyteller or the (real) New Millennium.

Dr. Pickering looks around and sees lots of old-timers' faces. He'll go back to the year 1 and talk about how we got where we are now. There's some 60 years of history here, and much of it was before there was a NASA.

Frank Malina

We'll start with the graduate student project of Frank Malina, who wanted to study the physics of rocketry in the mid-'30s. His major professor was horrified—rocketry had a disreputable, space-cadet cachet at that time. Few were doing any serious work in it. Robert Goddard was working in New Mexico on liquid-fueled rockets—but that was about it. Malina's professor thought he was out of his mind, but Frank was persistent. He talked to Theodore von Kármán, who encouraged him to pursue his interest. His initial experiments took place in the Aeronautics building—until the administration, in the interests of safety, urged him to work off-campus. So he settled in the dry wash at the upper end of the Arroyo Seco, not 400 yards from the bronze plaque just east of the Visitor's Center that commemorates his early efforts today. (See the photo from 1936.)

P-9007a JPL Photo Lab

How was Malina's early project supported? In one famous story, after one of his public seminars on rocketry, during which he mentioned a need for funds, he was approached by a graduate student named Arnold with a paper bag—full of cash! It held maybe $1000 in small bills. Malina never asked where it came from, and Arnold was never seen again. Eventually, government money became available.

JPL Goes to War

In those early days running an engine for 15 seconds before it blew up was an impressive feat—but the engines did get better. By the early '40s, JPL had developed pretty reliable motors of modest thrust in the tens-of-pounds range. We began to wonder how to apply them. Could you use them on airplanes? And so JPL developed the solid-fueled JATO (jet-assisted take-off) device to shorten the distance planes needed to take-off. (See the 1942 photo.)

The Navy liked the idea, too, but favored a liquid-fueled model, which they tested at (what is now) Edwards AFB.

We were at war then, and the military wanted more. So Aerojet was founded in 1942 by von Kármán and other JPLers to take advantage of the developments they'd pioneered, and exploit the demands of the commercial and government market. And in 1944, Frank Malina succeeded von Kármán as the second Lab director.

Rockets actually have a long military history. They were invented by the Chinese a thousand years ago. In the early 1800s they were used for bombardment—remember "the rockets' red glare" sung in the National Anthem? But they could not be aimed. With the development of rifled barrels, cannon soon dominated military ordnance, and the military rocket was all but forgotten.

In World War II, rockets returned to military arsenals. Small rockets were widely used in saturation bombardment to soften defenses before amphibious landings. These rockets were developed and built by a second Caltech rocket project, the Eaton Canyon Project, sponsored by the Navy. Before the end of World War II, this project delivered more than a million rockets to the Navy. The Inyokern rocket test facility was established to support this program. But, by the end of the war, Caltech was anxious to close the Eaton Canyon project and the Navy took over Inyokern.

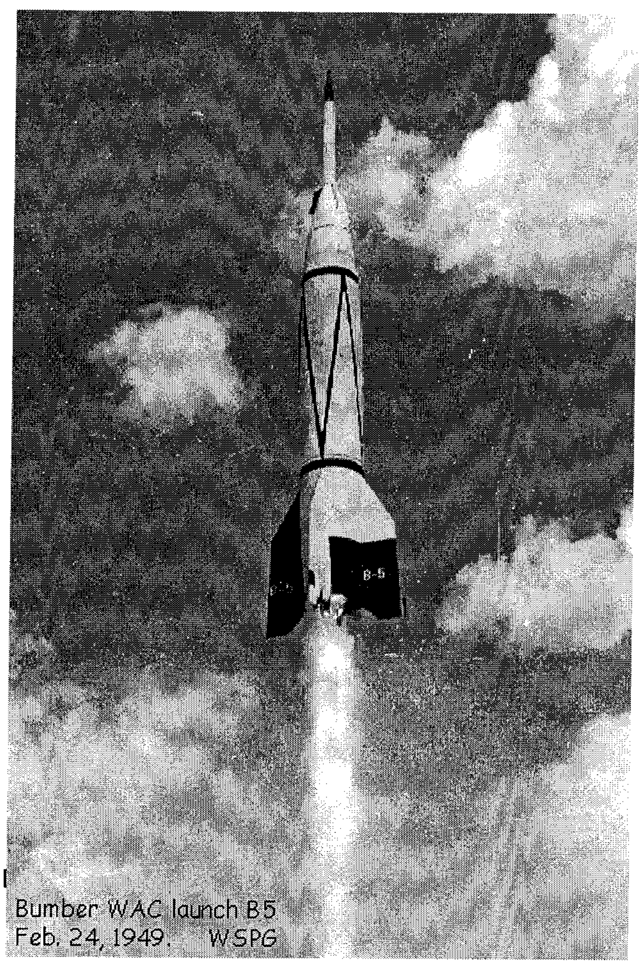
Before the end of the war, Malina's rocket project, which had been known as the GALCIT (Guggenheim Aeronautical Lab, Caltech) project changed its name to the Jet Propulsion Laboratory. The word "rocket" was still not in good standing.

JPL Extends Its Reach

The German development of the V-2, which had a range of 200 miles, led to Army Ordnance coming to the Lab and asking us to do research on such a ballistic rocket. We had already experimented with a small, solid-propellant, unguided rocket with a range of 10 miles which we called "Private." Now we were asked to build a much larger, guided rocket, so we called it "Corporal."

By 1947, with Louis Dunn now Lab Director, we were firing liquid-fueled rockets for Army Ordnance at the White Sands Proving Grounds, which was an extension of the old Fort Bliss Bombing Range. The Caltech program had developed from pure research in the physics, chemistry, and mechanics of rocket engines to development of real weapons systems. As the lab embarked on a new phase, established on the basics in solid- and liquid-fueled rockets developed at the Lab, they eventually closed the old test stands in the Arroyo.

The new phase depended on guidance and telemetry. One of the stars of 1947 was the WAC Corporal sounding rocket that could deliver data on atmospheric conditions 200,000 feet up. The lab provided a foretaste of things to come when we mounted a WAC corporal on the nose of a captured V2 as Project Bumper and launched the first two-staged rocket out of the atmosphere.



Bumber WAC launch B5
Feb. 24, 1949. WSPG

At the end of the War, the US army gathered the bulk of Germany's top rocket scientists (who preferred not to surrender to the advancing Russians). After a brief stop at Wright AFB, they settled at Ft. Bliss with about 50 captured V2s. The neighboring White Sands Bombing Range became a missile test range. When an early V2 wandered over the Mexican border and hit Juarez, the Army quickly developed a destruct mechanism for strays.

The need for a longer test range was obvious to the Army. Their first choice was to launch southeast from El Centro in southern California, near the northern end of the Gulf of California. But, perhaps with memories of Juarez still fresh, the Mexican Government objected and the Army turned to their second choice. Some of the now-famous two-stage Bumper WACs had been launched from Cape Canaveral in Florida in 1950, so the launch site was relocated near Patrick AFB. The southeast-stretching range needed listening posts, and with so many islands in the Caribbean run by a British government eager to share data, the Eastern Test Range became a reality.

In the new Missile Phase, with a stronger airframe, better control system, and lots of new and better plumbing, JPL's rockets—like the Corporal—were capable of delivering a 1000-pound warhead 100 miles. But the Army wanted a production version for use in the field by your average GI under *all* conditions.

Under Louis Dunn's direction, the Lab converted the research vehicle into a weapon. Production was contracted to Firestone and Gilfillan for mechanical and electrical components.

Since Corporal had been a research vehicle, it was not very successful. When the Army took bids for the replacement of the Corporal, JPL won the contract with Sergeant, which was solid-fueled, inertially guided, and ruggedized for use in the field. The Army selected Sperry Corporation for the production contract. These missiles, built in 1958, are still finding a use as research vehicles for upper air data collection. The University of Alaska has a research station at Poker Flats near Fairbanks, and Sergeant serves them well.

In the early 1950s the Lab had reached a pretty substantial size, boasting even a supersonic wind tunnel. But the basic research into rocketry, which involved storing toxic and unstable fuels, and firing within earshot of residences, was becoming too risky and expensive. Still the numbers continued to grow with more chemists, electricians, and support personnel. Many more came for electronics, guidance, telemetry, and instrumentation.

The Pickering Era

But the Sergeant project was the last JPL-developed missile. In 1954, the year Bill Pickering succeeded Louis Dunn as Lab Director, JPL was already moving to space exploration. The International Geophysical Year (July 1957 to December 1958) was an important driver. Atmospheric sounding rockets were to be widely used, and both the US and USSR had promised to launch artificial satellites.

The basic WAC Corporal design was adopted by Aerojet and developed into the Aerobee for upper-atmosphere research. The Aerobee's vertical flight profile generated lots of data, and it became a standard for the IGY.

Initially, the US government was unimpressed with the military future of the long-range rocket. The premier strategic weapon in the US arsenal was the hydrogen bomb, and, given the enormous size of the early models, no less than Vannevar Bush declared that the rocket could never deliver so heavy a weapon to target. The late 1940s saw no funds for development of such strategic weapons. The Soviets, however, were not listening; by 1955 they had developed the prototype for the Semyorka, the workhorse of their fleet.

The Semyorka was originally designed to throw a 6-ton warhead 7500 miles. The rocket that put the 184-pound Sputnik 1 into orbit developed 877,000 pounds of thrust at lift-off. Vanguard 1, by contrast, developed 28,000 lbs of thrust to orbit a 3.5-lb payload, and the Jupiter C that orbited the 30-lb Explorer 1 developed 83,000 lbs of thrust. Ed.

In the '50s, pure science was to be separate from military boosters, so the job of lofting the first US satellite went to the Navy and their Vanguard launcher. But in late 1957, the Vanguard, converted from the Viking sounding rocket, was in trouble.

Pickering was in Washington in early October, 1957, to attend a meeting of scientists reporting on progress in the IGY. Anatoliy Blagonravov, Chairman of the Soviet Academy of Science's Commission on Exploration and Use of Space, reported that a Soviet launch of an IGY satellite was near.

At the end of the week of meetings, on Friday evening October 4th, the group was invited to a reception at the Soviet Embassy. The first report that Sputnik I had been launched successfully came from a New York Times reporter, Walter Sullivan, who had been sent to the reception by his newspaper because of a broadcast from Moscow Radio. Lloyd Berker, the senior US scientist present, talked to the reporter and then proposed a toast to the Soviet success.

A small group of US scientists soon gathered at the IGY office nearby and sorted through numerous, mostly false, reports of seeing or listening to the Sputnik. Eventually with data from the RCA receiving station on Long Island, we were able to confirm the orbit of the satellite.

The Soviets stayed busy, launching a much larger Sputnik II with the dog Laika aboard on November 3. Because of the Navy's continuing problems with Vanguard, JPL and the Army were given the word on November 9 to prepare an alternate satellite (which von Braun had first proposed in 1954) for launch.

Meanwhile, the Navy forged ahead and, in a valiant effort to salvage national pride, launched on Dec 6. The rocket got a few feet off the pad before it blew into a million pieces. It was sad and acutely embarrassing.

On Jan 31 JPL's Explorer 1 roared into history atop one of the Army's Jupiter Cs. [See http://www.hq.nasa.gov/office/pao/History/sputnik/expinfo.html] It was a military launch, and no press had been invited (although the UPI had called in the middle of the month to check on the developing story).

Dr. Pickering was not at the Cape for the launch, but was, instead, at the Pentagon with Wernher Von Braun (whose Jupiter-C was a lineal descendant of the V-2s he had developed during the war) and James Van Allen of Iowa State University (who had designed and built the satellite's instrumentation). Without the elaborate communication network we have today, they had to communicate by phone and teletype to confirm the first orbit. Afterwards, they drove to the National Academy of Sciences—after midnight and in the rain—to meet the press. Their uncertainty over how their accomplishment would be met was quickly dispelled. The photo of the three of them (left to right—Pickering, Van Allen, and Von Braun) displaying a mock-up of the satellite like a trophy says it all.

A New NASA Center

Congress moved. By June 1958 a new NASA was created from the old NACA (National Advisory Committee on Aeronautics). It united a number of government research labs that focused on non-military aspects of space and aeronautical research. The new space agency became operational in October, and in December counted JPL as one of its brightest stars. Pickering was presented with a contract that offered three broad categories of space research: one that would include near-Earth satellite missions, looking both down at the surface, and out to the cosmos; a second that would become the manned space flight program; and a third that would include deep-space missions to explore the solar system *in situ*. Pickering did not hesitate to grab the deep-space contract for the Lab. It was one of the most fateful decisions he would ever make, and one for which we at the Lab will always be in his debt.

Interesting Web Sites

http://www.hq.nasa.gov/office/pao/History/sputnik/pickering.html

http://www.nzedge.com/heroes/pickering.html

http://www.jpl.nasa.gov/facts/jpl.pdf

http://www.friends-partners.org/mwade/project/explorer.htm

William Hayward Pickering, Ph.D.—A Brief Biography

William Hayward Pickering was born in Wellington, New Zealand, on December 24, 1910. After one year at the University of New Zealand, he entered Caltech in 1929. He received his Bachelor of Science degree in Electrical Engineering in 1932, the Master of Science degree in Physics in 1933, and his Doctorate in Physics in 1936, all from Caltech. After graduation, he joined the Caltech faculty, becoming a full professor of electrical engineering in 1946. During World War II, Pickering conducted research on the absorption properties of cosmic rays with Dr. Robert A. Millikan, and investigated Japanese balloon warfare techniques for the Army Air Corps.

Pickering was invited to join the Jet Propulsion Laboratory in 1944, on the basis of his experience in the design and use of telemetering devices. He was named chief of the Remote Control Section at JPL. Beginning in 1949, Pickering headed the Corporal and Sergeant missile programs, and in 1954 he succeeded Louis Dunn as Laboratory director.

In November 1957 JPL and the Army Ballistic Missile Agency were directed to prepare and orbit an artificial satellite, in the wake of the launching of Sputnik by the Soviet Union, and the failure of the American Vanguard satellite.

Explorer 1, the first U.S. artificial satellite, was launched on January 31, 1958.

In December 1958 JPL was transferred to the newly created NASA. In January 1959, JPL was assigned responsibility for the robotic exploration of the moon and planets. Under Pickering's direction, JPL supervised the Ranger missions returning the first close-up, high-resolution pictures of the lunar surface; he also supervised the Surveyor soft-landers on the Moon; the Mariner missions to Mars and Venus; and the first gravity-assist mission to Mercury, via Venus. JPL also designed the Viking Orbiters to Mars and designed and built the Voyager spacecraft for their mission to the outer planets.

After Pickering's retirement from JPL in 1976, he directed the Research Institutes of Saudi Arabia's University of Petroleum and Minerals. In 1978 he returned to California and established the Pickering Research Corporation for space-related projects. In 1983, he formed Lignetics, Inc., to manufacture wood pellets from wood waste for use in home heating.

Pickering has received numerous national and international honors, which include NASA's Distinguished Service Medal, the Prix Galabert of France, Italy's Order of Merit.

Pickering was also awarded the Robert H. Goddard Trophy from the National Space Club, the British Interplanetary society's Special Award, the 1957 James Wyld Award of the American Rocket Society, the 1959 U.S. Army's Distinguished Civilian Service Medal, the 1969 Louis B. Hill Award of the American Institute of Aeronautics and Astronautics, the 1968 Arthur Noble award from the City of Pasadena and in 1993 the inaugural Francois-Xavier Bagnoud Aerospace Prize. Pickering was featured on the cover of Time magazine in 1963 and 1965, and was grand Marshall of the Tournament of Roses Parade in 1963.

Pickering has also been honored by national leaders. In 1975, he was awarded the National Medal of Science from President Gerald Ford. In 1976, Pickering was made an "Honorary Knight Commander of the Civil Division of the Most Excellent Order of the British Empire" by Queen Elizabeth, and in 1994 he was awarded the Japan Prize by Emperor Akihito.